

CALIBRATION STANDARD REQUIREMENT

FOR AN

ELECTRONIC COUNTER

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PROCUREMENT PACKAGE

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# CALIBRATION STANDARD REQUIREMENT FOR AN ELECTRONIC COUNTER

## 1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for an Electronic Counter. This equipment is intended to be used by Navy personnel in shipboard and shorebased laboratories to calibrate frequencies, periods, and time intervals of continuous wave and pulsed signals from dc to 500 MHz. Capabilities shall be provided for calibrating frequencies to 40 GHz when used with frequency converter and converter heads. The equipment shall be capable of housing and powering Hewlett-Packard 5355A frequency converters which are in the Navy inventory. For the purpose of this requirement, the Electronic Counter shall be referred to as the EC.

## 2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military requirement, Test Equipment for use with Electrical and Electronic Equipment, General specification for," and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this requirement.

## 3. REQUIREMENTS

3.1 General. The EC shall conform to the Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased equipment as modified below. The use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Design and Construction. The EC design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.2 Power requirements. The EC shall operate from a source of 103.5V to 126.5V at 60 Hz (5% single-phase input power as specified in MIL-T-28800).

3.1.2.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line, defined by MIL-T-28777, shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.2.2 Power Connection. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6-foot (1.8 m) minimum length of cord.

3.1.3 Dimension and Weight. Maximum dimensions shall not exceed 19 inches (48 cm) in width, 6 inches (15 cm) in height, and 20 inches (51 cm) in depth. The weight shall not exceed 40 pounds (18 kg).

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the cognate activity.

submitted to the procuring activity at the time of submission of proposal. Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The EC shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviation specified below.

3.2.1 Temperature and Humidity. The EC shall meet the conditions below:

|               | <u>Temperature((C)</u> | <u>Relative Humidity(%)</u> |
|---------------|------------------------|-----------------------------|
| Operating     | 10 to 30               | 95                          |
|               | 30 to 40               | 75                          |
| Non-operating | -40 to 70              | Not controlled              |

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE02, CS01, CS02, CS06, RE01, RE02 (14 kHz to 1 GHz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The EC shall have an 85% or greater probability of remaining within tolerances of all requirements at the end of a 12 month period.

3.4 Maintainability. The EC shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 60 minutes.

3.5 Performance Requirements. The EC shall provide the following capability as specified below. Unless otherwise indicated, all requirements shall be met following a 30-minute warm-up period.

3.5.1 Input Characteristics. The EC shall measure frequencies from dc to at least 500 MHz. Two separate inputs, channels A and B, shall be provided for the entire frequency range. The following defines the specifications for these two input channels. The EC shall be at least equal to or better than these limits.

3.5.1.1 Sensitivity. The EC shall measure the frequency of the applied signal over the following input signal levels and attenuation ranges.

| <u>Attenuator Setting</u> | <u>Input Voltage Range</u>               |
|---------------------------|--|
| X1                        | 25 mV rms sinewave and 75 mV p-p pulse   |
| X10                       | 300 mV rms sinewave and 900 Mv p-p pulse |

3.5.1.2 Dynamic Amplitude Range (50 ohm & 1 megohm). The dynamic range of channels A and B shall be equal to or greater than:

X1: 25 mV to 300 mV rms sinewave, and  
75 mV to 900 mV p-p pulse

X10: 300 mV to 2 V rms sinewave, and  
900 mV to 6.0 V p-p pulse

3.5.1.3 Trigger Level. The EC shall have the following trigger level requirements.

3.5.1.3.1 Range. The EC trigger level control shall be adjustable from -2V dc to +2V dc minimum. A preset shall be provided for centering the trigger level to 0 Vdc nominal.

3.5.1.3.2 Slope. The slope of the trigger for inputs to channels A and B shall be negative and positive, independently selectable for each channel.

3.5.1.3.3 Output. The EC shall provide channels A and B trigger voltage output at the rear panel.

3.5.1.4 Impedance. The input impedance of channels A and B shall be independently selectable to 50 ohms or 1 megohm shunted by less than 45 pF when separate signals are applied to each channel; and 500 kohms shunted less than 80 pF, when connected for common A input.

3.5.1.5 Coupling. The coupling shall be AC or DC switchable.

3.5.1.6 Damage Level. The EC shall not be damaged when the applied signals are 3.5 V or less.

3.5.1.7 Separate/Common. The EC shall provide for SEPARATE channel A and B inputs or for COMMON A input.

3.5.2 Frequency. The EC shall measure the frequency of applied continuous wave and pulsed signals from DC to at least 500 MHz.

3.5.2.1 Digits Displayed. The EC frequency display shall be at least 9 digits per second of gate time.

3.5.2.2 Uncertainty. The frequency uncertainty (in Hertz) shall not exceed:

$$[5 (-10^{(gate\ time\ in\ seconds)}) (-2^{-7})] 10^{(Frequency)}$$

3.5.3 Period. The EC shall have the following requirements.

3.5.3.1 Range. The EC shall measure periods at least from 2 ns to 20,000 s.

3.5.3.2 Least Significant Digit (LSD) Displayed. The EC period display shall be at least 9 digits per second of gate time.

3.5.3.3 Uncertainty. The EC period uncertainty in seconds shall not exceed:

$$[5 \times 10^9 / (\text{gate time in seconds}) + 2^{-7} \times 10 (\text{period in seconds})]$$

3.5.4 Time Interval. The EC shall have the following time interval requirements.

3.5.4.1 Range. The EC shall measure time interval at least from 10 ns to 20,000 s.

3.5.4.2 Resolution. The resolution of period measurements shall not exceed (2 ns when in time interval mode, and not exceed (2 ps when in time interval averaging mode.

3.5.4.3 Uncertainty. The EC time interval uncertainty shall not exceed (2 ns.

3.5.5 Ratio B/A. The EC shall have the following ratio requirements.

3.5.5.1 Range. The EC shall provide ratio B/A measurements for frequencies up to 500 MHz.

3.5.5.2 Least Significant digit (LSD) Displayed. The ratio B/A LSD displayed shall be at least:

$$\text{Ratio} / (\text{Freq. B} \times \text{Gate Time})$$

3.5.5.3 Resolution. The resolution of ratio B/A LSD displayed shall not exceed:

$$\frac{(1 \text{ count of LSD})}{\text{Gate Time}} \times \frac{1}{1.4} \left( \frac{\text{Trigger Error of Ch. A}}{\text{Ratio}} \right)$$

3.5.5.4 Uncertainty. The ratio B/A uncertainty shall be the same as the resolution.

3.5.6 Totalizing. The EC shall accumulate and display the input pulses.

3.5.7 Time Base. The EC shall meet the following time base requirements.

3.5.7.1 Frequency Reference Output. The EC shall provide a 10 MHz, sinewave frequency output of at least 1 V rms into 50 ohms.

3.5.7.2 Long Term Stability. The frequency uncertainty rate of change due to aging shall not exceed  $5 \times 10^{-10}$  per day after a 24-hour warm-up at a constant temperature.

3.5.7.3 Short Term Stability. The frequency uncertainty rate of change due to short term stability shall not exceed  $1 \times 10^{-11}$  for 101 second averaging.

3.5.7.4 Temperature Stability. The frequency change shall not exceed  $7 \times 10^{-9}$  over the 10(C to 40(C temperature range.

3.5.7.5 Line Voltage Stability. The frequency change shall not exceed  $1 \times 10^{-10}$  for a (10% line voltage from nominal).

3.5.7.6 External Frequency Input. The EC shall accept frequency references of 1, 5, or 10 MHz with an input level of 1 V rms into 1 K ohm.

3.6 Operating Requirements. The EC shall provide the following operating capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The location and labeling of indicator controls, and switches shall provide for maximum clarity and easily understood operation without reference to tables, charts, or flow diagrams.

3.6.2 Programmability. All modes and function shall be fully remotely programmable via the IEEE-488.1 instrumentation bus. When operating the via remote programming, all front panel controls shall be disassembled, except for the On/Off switch and the Remote/Local switch.

3.6.3 Local/Remote. The EC shall have a local and remote operation mode. It shall be either manually or remotely programmable selectable according to paragraph 3.6.2. Manual selection shall be provided by a front panel switch. A means of indicating the operational mode shall be provided. When changing modes, all parameter values shall remain unchanged.

3.6.4 Self-Test. The self-test shall comprise two selectable levels, an operational test to determine if the instrument is operationally ready, and a second level diagnostic test to diagnose and isolate faulty field replaceable modules. When the self-test function is initiated, an auto-sequenced interoperation test shall be performed. The diagnostic test shall be selectable only by deliberate operator command.

3.6.5 IEEE Interface. The EC shall have an IEEE-488.1 interface connector with the following capabilities: SH1, AH1, T6, L4, SR1, RL1, DT1. Serial poll capability shall be provided.

3.6.6 Compatibility. The EC shall be tested for compatibility with the IEEE-488 bus and the John Fluke 1722A/AP instrument controller. The EC shall be tested for physical and electronic compatibility with the Hewlett Packard model 5355A counter plug-in.

3.6.7 Sample Rate Control. The EC shall be provided with a sample rate control which controls time between measurements and is variable from less than 100 ms to HOLD. At HOLD position, the display shall be held indefinitely.

3.6.8 Gate Time. The gate time shall be from 1,000 s to 100 ns in decade steps, and shall be less than 50 ns when in minimum position.

3.6.9 Self-Check. The EC shall provide a self-check function selectable via front panel control.

3.6.10 Connectors. All front and rear panel connectors shall be BNC-type female.

3.7 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.7.1 Calibration Procedure. The manual shall include a calibration procedure accordance with MIL-M-38793.

3.8 Accessories. The EC shall include the following:

3.8.1 Cable. The EC shall have one IEEE-488.1 GPIB cable, 6-foot (1.8 m) minimum length.